

Fabrication of Partially Transparent Petaled Masks Using Gray Scale Lithography

Completed Technology Project (2013 - 2015)



Project Introduction

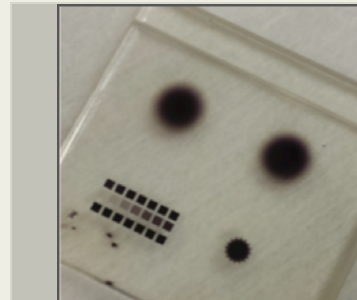
In this study we intend to fabricate partially transparent petal (PTP) masks using gray scale lithography on high-energy beam sensitive (HEBS) glass and evaluate its performance in on-going light suppression experiments at Goddard. Preliminary laboratory results from traditional lithography fabricated masks and our published mathematical analyses show PTP masks using gray scale lithography could achieve superior light suppression along the optical axis not obtainable with binary petaled masks. The fabrication process involving low cost gray scale lithography would enable NASA to assess the feasibility of this technology as a means of achieving 3D micro/nano fabrication processes for future device manufacturing.

Our main objective in this study is to design, fabricate, and analyze the partially transparent petaled (PTP) masks using gray scale lithography to suppress the diffracted light along the optical axis of secondary mirror of the New Space-based Gravitational-wave Observatory (NGO) telescope.

Anticipated Benefits

Suppression of reflected light at the optical axis of secondary mirror of space telescope

Wideband coronagraphy mask for suppression of light intensity at transmission region



Grayscale lithography fabricated mask on HEBS glass

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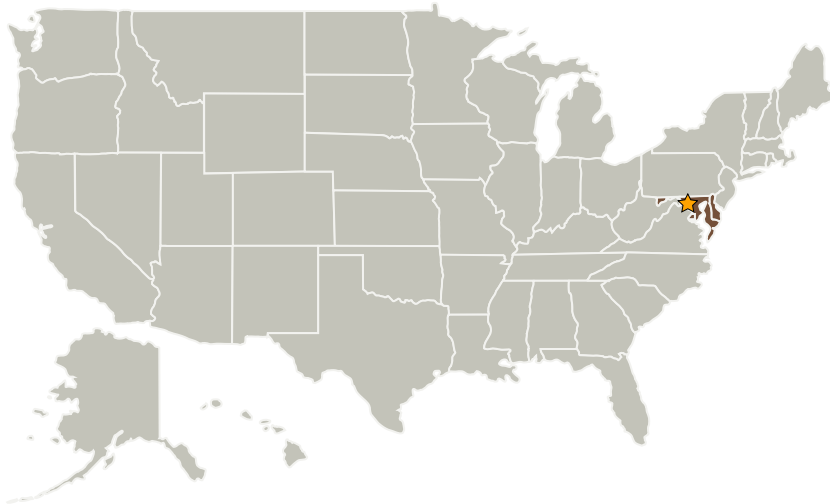
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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland
George Washington University	Supporting Organization	Academia	Washington, District of Columbia
University of Delaware	Supporting Organization	Academia	Newark, Delaware

Primary U.S. Work Locations	
Delaware	District of Columbia
Maryland	

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Center Independent Research & Development: GSFC IRAD

Project Management

Program Manager:

Peter M Hughes

Project Manager:

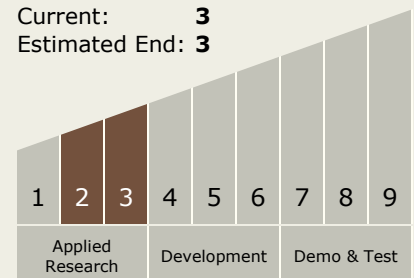
Terence A Doiron

Principal Investigator:

Ron S Shiri

Technology Maturity (TRL)

Start: 2
Current: 3
Estimated End: 3



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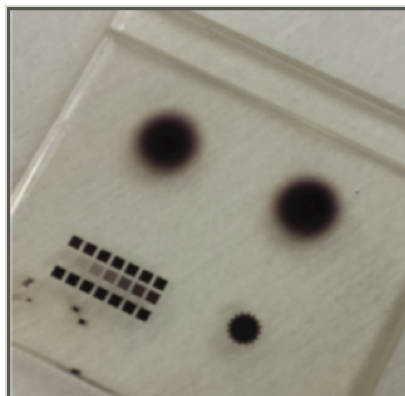
Images



Fabrication of Partially Transparent Petaled Masks Using Gray Scale Lithography Project

Close up photo of mask

(<https://techport.nasa.gov/image/4092>)



Fabrication of Partially Transparent Petaled Masks Using Gray Scale Lithography Project (PTP Mask)

Grayscale lithography fabricated mask on HEBS glass

(<https://techport.nasa.gov/image/4091>)

Project Website:

<http://aetd.gsfc.nasa.gov/>

Technology Areas

Primary:

- TX08 Sensors and Instruments
 - └ TX08.2 Observatories
 - └ TX08.2.1 Mirror Systems